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NOMENCLATURE OF
PATHOGENIC AND
PARASITIC ORGANISMS

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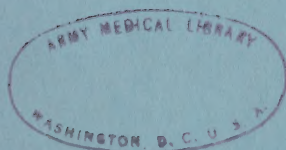
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NOMENCLATURE OF PATHOGENIC AND PARASITIC ORGANISMS



1945



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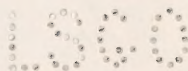
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PREFACE

This booklet is not intended as a guide to the etiology of communicable diseases. That has been the subject of another publication "Physicians' Guidebook to Public Health Laboratory Services". This is a companion publication which supplements the "Guidebook" by listing, with a few facts about each, the scientific names of bacteria and parasites which may appear on reports from the Bureau of Laboratories. This has been done in the past only for bacteriological names which have been listed previously in two separate publications¹.

Scientific nomenclature provides a means which enables a laboratory worker to report the presence of a specific living organism or group of organisms in one or two words in such a way that a physician or another laboratory worker may know exactly what has been found or may consult a reference work to find a detailed description of the organism and its significance. Because physicians would otherwise have to keep a number of reference books readily available, this compilation has been conceived and printed for use by physicians as a single reference source when receiving reports of bacteriological and parasitological examinations. For that reason, facts of interest to the physician have been stressed and other descriptive items kept to a minimum.

Another purpose in mind during the preparation of this booklet has been the assembling in one place of a standard nomenclature where it will be available for use by public health and medical laboratories in Connecticut. The use of this list by workers in local laboratories is urged in the interests of uniformity.

The subject matter of this booklet is divided into eight sections as follows: I. BACTERIA; II. RICKETTSIAL ORGANISMS; III. FUNGI: MOLDS AND YEASTS; IV. PARASITIC PROTOZOA; V. TREMATODES (FLUKES); VI. CESTODES (TAPEWORMS); VII. PARASITIC NEMATODES (ROUNDWORMS); VIII. MISCELLANEOUS PARASITIC HELMINTHS (WORMS). Each section is arranged according to genera in alphabetical order. Important species are discussed under the genus to which each belongs. A complete index is provided so that the page on which a given organism is described may be found readily. In the index, names in current use are printed in bold face type.

The nomenclature of living organisms is a field too often dismissed by most persons in the medical and public health professions as an academic question with little practical application. *Canis familiaris* is adequately identified for most purposes when called simply dog, perhaps setter or mongrel. Neither he nor we derive any particular benefit from the use of his correct but unwieldy scientific name. No one needs to use scientific names to decide if he is dog, wolf, jackal or coyote. Nevertheless, we are faced with a different situation when we find amebae in the stools of a given individual for it is a matter of considerable concern to the individual, to his doctor and to the public health to know whether these amebae are *Endameba histolytica*, a pathogenic species, or *Endameba coli*, a perfectly innocuous intestinal parasite. Furthermore, it is of little value to the epidemiologist to know that there are fifty cases of *Salmonella* infection in a city unless he also knows either that these have all been caused by one type or that each has been caused by a different type. Thus, the use of scientific

¹Mickle, Friend Lee. Bacteriological Nomenclature. Conn. Health Bull., 41 (2): 40. 1927.

²Borman, Earle K. Bacteriological Nomenclature Used in the Bureau of Laboratories. Conn. Health Bull., 54 (4): 112. 1940.

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names — the familiar names of the microbiology of disease — becomes mandatory because a useful purpose is served when they are employed in the proper manner.

It is unfortunately all too true that many authorities have gone separate ways in the use of scientific names. Some relatively well known agents of disease have been called by ten or even twenty names which appear unrelated but are synonymous. Recent efforts to bring order out of the resulting chaos have not always been too successful although good progress has been made.

The main problem which has faced the author of this booklet has been the selection of names which have authority and have been proposed along with adequate and unambiguous descriptions of the things named. Consequently, names which will be unfamiliar to many appear in the list, and a few familiar names have been dropped entirely because they have been used so loosely that they do not apply to one species alone but actually mean one thing to one person and something entirely different to another. In the face of this confusion, the name selected as most authoritative for the purpose of this listing is followed in the text by those synonyms which have been used most frequently. These synonyms are, with few exceptions, without sufficiently clear-cut authority for use. Most of them will one day be forgotten and we may just as well learn now to do without them.

The section dealing with the BACTERIA contains with few exceptions the names of organisms as given in "Bergey's Manual of Determinative Bacteriology", 5th Ed., (Williams and Wilkins Co.). Departures from this authority are few and have been made after thorough consideration. That manual is now in the process of revision so that some names given herein may be superseded by others as soon as the sixth edition of the manual is in print. Uncertainty as to the date of publication of the new edition is so great that it has not been considered advisable to delay publishing this manual until its appearance.

The RICKETTSIAL ORGANISMS are listed under names most frequently used. This has been done after considering most of the current literature.

Among the FUNGI many molds and yeasts are described, some by names as yet relatively unfamiliar to the medical profession. The listing given is the result of a choice between two evils. The author has debated between the use of familiar but improper names found in the medical literature and the use of unfamiliar names assigned by those who have written precise descriptions of the organisms in question. In each case, it has seemed desirable to sacrifice familiarity for accuracy. Thus, physicians will find names such as "*Monilia albicans*" and "*Torula histolytica*" appearing only as synonyms for the more exact names *Syringospora albicans* and *Cryptococcus histolytica*, respectively. Conversely, mycologists of the systematic school will disagree with the inclusion of *Actinomyces* and *Erysipelothrix* as two distinct genera with the bacteria and with a similar disposition of "*Streptobacillus moniliformis*". By and large Dodge's "Medical Mycology" (C. V. Mosby Co.) has been used as the authority for the fungi.

Similar problems have presented themselves in the sections on PARASITIC PROTOZOA, TREMATODES, CESTODES, PARASITIC NEMATODES and MISCELLANEOUS PARASITIC HELMINTHS. Here, however, there is much greater agreement among recent authori-

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ties than in the other fields. The system followed herein is not entirely that of any given authority. Only in a few instances has it been necessary to choose a name which seemed the more suitable or more applicable among those given by conflicting authorities.

It is as yet too early to assign names to filterable viruses in the preparation of a reference volume such as this. Beginnings in this field are being made but it is at present preferable to identify these viruses by associating them with the disease produced by each. Consequently, the terms "mumps virus", "influenza virus" and the like are still sufficiently descriptive.

This booklet has been contemplated as a first edition, a beginning only. Taxonomy, the science upon which nomenclature is based, may seem dry to many but it is most certainly not static. Revisions will, therefore, be necessary. It will be helpful if those who use this booklet will express their criticisms. Constructive criticism, favorable or unfavorable, will be most valuable when the time comes for revision.

EARLE K. BORMAN.

I. BACTERIA

Achromobacter

A genus of gram-negative, rod-shaped, non-sporogenous bacteria common in water and soil; presence in medical specimens probably adventitious and of no significance.

Actinobacillus

A genus of gram-negative, pleomorphic, non-sporogenous, rod-shaped bacteria pathogenic for animals and man (actinobacillosis); lesions often confused with actinomycosis; lesions found in soft tissues, generally lymph nodes.

Actinomyces

(*Nocardia*; *Oospora*; *Discomyces*; *Streptothrix*; *Actinocladothrix*; *Micromyces*; *Actinobacterium*; *Carteria*; *Cohni-streptothrix*) — A genus grouped by some with the fungi (molds) and by others with the bacteria; a few species produce infections in man collectively known as actinomycoses; widely distributed. The parasitic species include:

Actinomyces asteroides

(*Cladothrix asteroides*; *Streptothrix eppingeri*; *Oospora asteroides*) — Associated with white grained mycetomas in various parts of the world.

Actinomyces bovis

(Many synonyms but, in particular, *Actinomyces israeli*) — The cause of "lumpy jaw" of cattle; may be identical with *Actinomyces hominis*.

Actinomyces hominis

(*Streptothrix hominis*) — Considered to be the principal cause of actinomycosis in man; morphologically indistinct from *Actinomyces bovis*.

Actinomyces madurae

(*Streptothrix madurae*; *Oospora madurae*; *Cladothrix madurae*) — Causes a white grained mycetoma of man.

Aerobacter

(*Aerogenesbacterium*) — A genus of the coliform group of gram-negative, non-sporogenous, rod-shaped bacteria; chiefly soil types; frequently found in normal stools; generally of no significance but reported as cause of urinary tract infections and as secondary invaders in pyogenic infections; so-called "paracolon" types may have pathogenic properties. The principal species is:

Aerobacter aerogenes

(*Bacterium lactis aerogenes*; *Bacillus lactis aerogenes*; *Encapsulatus lactis aerogenes*; *Colobactrum aerogenes*)
—Ubiquitous in nature.

Alcaligenes

A genus of predominantly gram-negative, non-sporogenous, rod-shaped bacteria; several species normally present in the intestinal tract; usually of no medical significance unless isolated from the blood stream or from catheterized urine.

Bacillus

(Many synonyms) — A large genus of aerobic, spore-forming bacteria widely distributed in nature; common in inadequately sterilized materials of any sort. One species is highly pathogenic:

Bacillus anthracis

(*Bacterium anthracis*) — The cause of anthrax in animals and man; spread from infected animals to man when spores enter through abrasions of the skin or are inhaled; resistant spores may survive for very long periods of time on hides and hair of diseased animals.

Bacterium

A genus currently containing only non-sporogenous, rod-shaped bacteria of doubtful classification; not pathogenic for man.

Bacteroides

A genus of gram-negative, non-sporogenous, rod-shaped bacteria, strictly anaerobic; cultures isolated from the blood stream, from spinal fluid or from suppurating or gangrenous lesions probably have significance; otherwise these organisms are of no significance.

Borrelia

A genus of spirochetal organisms containing forms pathogenic for man and animals; species causing relapsing fever in various sections of the world not clearly differentiated from each other. The species include:

Borrelia duttonii

(*Spirocheta duttoni*; *Spirillum duttoni*; *Spiroschaudinnia duttoni*; *Treponema duttoni*) — The cause of tick-borne African relapsing fever; considered identical with *Borrelia recurrentis* by some observers.

Borrelia novyi

(*Spiroschaudinnia novyi*; *Spironema novyi*; *Treponema novyi*) — The cause of tick-borne American relapsing fever in the western United States.

Borrelia recurrentis

(*Spirocheta recurrentis*; *Spirocheta obermeieri*; *Spirillum obermeieri*; *Spiroschaudinnia recurrentis*; *Treponema recurrentis*) — The cause of European relapsing fever, usually louse-borne; regarded by some as the only valid name for all relapsing fever spirochetes with the various types included as subspecies or varieties.

Borrelia refringens

(*Spirocheta refringens*; *Spironema refringens*; *Treponema refringens*) — An apparently harmless spirochete often found on the genitalia of man and sometimes confused by the inexperienced with the *Treponema pallidum* of syphilis.

Borrelia vincentii

(*Spiroschaudinnia vincenti*; *Treponema vincenti*; *Spironema vincenti*) — Spirochetal organisms associated with *Fusobacterium* in Vincent's infection (trench mouth) and as secondary invaders in gangrenous lesions.

Brucella

A genus of small, gram-negative, non-sporogenous rod-shaped bacteria pathogenic for man and animals; principally associated with contagious abortion of cattle and other animals and with brucellosis (undulant fever) of man. The species include:

Brucella abortus

(*Bacterium abortus*; *Bacillus abortus*; *Alcaligenes abortus*) — The bovine type; principal cause of brucellosis of man in the United States; transmitted usually through raw milk.

Brucella melitensis

(*Micrococcus melitensis*; *Bacillus melitensis*; *Bacterium melitense*; *Alcaligenes melitensis*) — The caprine type; a principal cause of brucellosis of man in regions where goat milk is consumed raw.

Brucella suis

(*Bacillus abortus suis*) — The porcine type; transmissible to cows and thence to man; also transmissible from hogs to man through abraded skin.

Clostridium

A large genus of predominantly anaerobic, spore-forming bacteria; numerous species of medical importance (botulism, tetanus, gas gangrene). The species include:

Clostridium botulinum

(*Bacillus botulinus*) — Produces a potent toxin when permitted to grow anaerobically in suitable, usually non-acid foods; present in the soil; dangerous as a contaminant of improperly canned foods; toxin causes botulism in man and animals.

Clostridium perfringens

(*Bacillus aerogenes capsulatus*; *Clostridium welchii*) — One of the many species producing **gas gangrene in deep wounds**; widely distributed in soil, feces and sewage.

Clostridium tetani

(*Bacillus tetani*) — The cause of tetanus (lockjaw) which results from the elaboration of a powerful toxin by this organism growing in wounds where oxygen cannot penetrate; common in soil and feces.

Corynebacterium

A genus of gram-positive, non-sporogenous, rod-shaped bacteria including the cause of diphtheria; other species may be significant when isolated from suppurative lesions.

Corynebacterium diphtheriae

(*Bacillus diphtheriae*; *Bacterium diphtheriae*) — The diphtheria bacillus; elaborates a potent toxin, usually in the throat, which is responsible for symptoms; may be present in healthy carriers who are immune to the toxin.

Dialister

A genus of small, anaerobic, non-sporogenous, rod-shaped bacteria; cultivable with difficulty from the respiratory tract of man; often associated with influenza but not considered of etiological significance although strictly parasitic.

Diplococcus

A genus of gram-positive cocci occurring characteristically in pairs; common on mucous membranes; may invade tissues to cause pyogenic infections; one species causes pneumonia and sequelae in man:

Diplococcus pneumoniae

(*Diplococcus lanceolatus*; *Pneumococcus lanceolatus*)

— The pneumococcus, a capsulated species divided into many serological types determined by capsular constituents; the most common cause of lobar pneumonia; may cause localized suppurative lesions in the middle ear, mastoid processes, conjunctiva, meninges, etc.; may be present on membranes of nose and throat of healthy carriers.

Eberthella

A poorly constituted genus of gram-negative, non-sporogenous, rod-shaped bacteria including one species of medical importance, the typhoid fever organism:

Eberthella typhosa

(More properly, *Salmonella typhosa*; also has been termed *Bacillus typhosus* and *Bacterium typhi*) — The cause of typhoid fever in man; spread through food and water contaminated by feces or urine from cases and carriers; contamination may be fly-borne.

Erysipelothrix

A genus of organisms grouped by some with the fungi (molds) as *Actinomyces* and by others with the bacteria; parasites of man and animals. The species include:

Erysipelothrix erysiploidis

(*Oospora erysiploidis*; *Streptothrix rosenbachii*; *Actinomyces erysiploidis*) — A cause of an erysiploid infection of man.

Erysipelothrix rhusiopathiae

(*Actinomyces thuillicri*) — The cause of swine erysipelas; found also in crabs and other crustacea; produces infections of man handling infected animals and crustacea.

Escherichia

(*Colibacterium*) — A genus of gram-negative, non-sporogenous, rod-shaped bacteria; common in the intestines of man and animals; not ordinarily pathogenic although it may invade tissues causing cystitis, pyelitis, or localized suppurative lesions; “paracolon types” may have pathogenicity for man. The species include:

Escherichia coli

(*Bacillus coli communis*; *Colobactrum coli*) — The common coliform organism predominant in the intestine of warm-blooded animals and man.

Escherichia freundii

(*Bacterium freundii*; *Citrobacter freundii*; *Colobactrum freundii*) — A common coliform organism widely distributed in nature and frequently encountered in feces.

Fusobacterium

A genus of fusiform bacteria associated (often together with *Borrelia*) with Vincent's infection (trench mouth), gingivitis or infections where decaying tissue may serve as a food supply; frequently found on otherwise normal mucous membranes; probably does not invade tissue unless trauma or other infection causes an accumulation of dead tissue cells.

Gaffkya

A genus of gram-positive cocci commonly found on mucous membranes and skin; very rarely the cause of infections.

Hemophilus

A genus of small, pleomorphic, gram-negative, rod-shaped organisms; strictly parasitic. Species of medical importance are:

Hemophilus ducreyi

The cause of chancroid (soft chancre).

Hemophilus duplex

(*Hemophilus lacunatus*) — The cause of acute conjunctivitis (Morax-Axenfeld organism).

Hemophilus influenzae

(*Bacterium influenzae*; *Hemophilus conjunctivitis*)
— The so-called influenza bacillus, at one time falsely thought to be the cause of influenza; also described as the Koch-Weeks bacillus; a common cause of meningitis of children under 3-5 years of age and the cause of a conjunctivitis (pink eye) in man.

Hemophilus pertussis

The cause of whooping cough (pertussis).

Klebsiella

A poorly defined genus of gram-negative, usually encapsulated, rod-shaped bacteria closely related to and possibly identical with *Aerobacter*. The species include:

Klebsiella granulomatis

(*Encapsulatus inguinalis*) — Found in lesions of granuloma inguinale; may be identical with Donovan bodies.

Klebsiella pneumoniae

(*Bacterium pneumoniae*; *Bacterium friedlanderi*) — The Friedlander bacillus, a cause of severe pneumonia; has a number of serological types dependent upon capsular constituents.

Kurthia

A genus of gram-positive, non-sporogenous, rod-shaped bacteria living as saprophytes in decomposing materials; of no medical significance when isolated.

Leptospira

A genus of parasitic spirochetal organisms infecting man and animals. The species include:

Leptospira canicola

A parasite of animals, chiefly dogs, which causes leptospirosis (infectious jaundice) of man; transmitted generally through the urine of animals.

Leptospira hebdomadis

The cause of "seven day fever" in Japan; a parasite of field mice transmitted to man through their urine.

Leptospira icterohemorrhagiae

(*Spirocheta icterohemorrhagiae*; *Treponema icterohemorrhagiae*) — The cause of an infectious jaundice of man (Weill's disease) referred to as leptospirosis; spread through rat urine.

Leptospira morsus-muri

(*Spirillum minus*) — An organism of doubtful position causing rat-bite fever (sodoku) in man.

Leptotrichia

A genus of branching bacteria found in the oral cavity; probably not pathogenic.

Listerella

(*Listeria*) — An imperfectly defined genus of rod-shaped bacteria causing diseases in animals characterized by monocytosis; a possible cause of infectious mononucleosis of man.

Malleomyces

(*Pfeifferella*; *Loefflerella*) — A genus of rod-shaped, possibly branching bacteria of uncertain position but containing forms causing serious diseases in animals and man. The species include:

Malleomyces mallei

(*Bacillus mallei*; *Bacterium mallei*; *Actinobacillus mallei*) — The cause of glanders; transmissible to man mainly through nasal secretions of equines.

Malleomyces pseudomallei

(*Bacillus whitmori*; *Actinobacillus pseudomallei*) — The cause of melioidosis, a glanders-like disease of animals and man in India, the Malay States and Indo-China.

Micrococcus

A genus of gram-positive cocci widely distributed in nature; commonly found on skin and mucous membranes; occasionally causes pyogenic infections and more rarely bacteriemia.

Mycobacterium

A genus of acid-fast, rod-shaped bacteria of medical importance although many species are non-pathogenic. The species pathogenic for man are:

Mycobacterium leprae

(*Bacillus leprae*) — Occurs in lesions of leprosy; the accepted cause of the disease.

Mycobacterium tuberculosis

(*Bacillus tuberculosis*) — The cause of tuberculous infection in man; one type (human) predominant in pulmonary infections transmissible from man to man; another type (bovine) predominant in other tuberculous infections (bones, etc.) and usually acquired in childhood by drinking raw milk from tuberculous cattle; a third type (avian) is not generally thought to be capable of producing tuberculous infections in man.

Neisseria

A genus of gram-negative cocci occurring characteristically in pairs; strictly parasitic on the skin and mucous membranes; some species are the causes of specific infections, others may play a minor role in pyogenic infections and bacteriemia. The important species are:

Neisseria gonorrhoeae

The gonococcus causing acute and chronic gonococcal infections.

Neisseria intracellularis

(*Diplococcus intracellularis meningitidis*; *Micrococcus intracellularis*; *Neisseria meningitidis*) — The meningococcus causing infections such as epidemic cerebrospinal fever (meningitis) and meningococcemia; may be present in the nasopharynx of "healthy carriers".

Noguchia

A genus of small, gram-negative, non-sporogenous, rod-shaped bacteria sometimes associated with a follicular type of conjunctivitis in animals and man; one species formerly thought to be the cause of trachoma.

Paracolonbacterium

A proposed genus constituted to include all "paracolon" types of coliform organisms producing gas in carbohydrates; some of these are pathogenic for cold-blooded animals and have been isolated from the blood of warm-blooded animals and man under conditions pointing to etiological significance.

Pasteurella

A genus of small, gram-negative, non-sporogenous, rod-shaped bacteria important in human and veterinary medicine. The species include:

Pasteurella pestis

(*Bacterium pestis*; *Bacillus pestis*) — The cause of plague (bubonic and pneumonic) in man and rodents; bubonic type spread from rodents to man by insect vectors, principally rat fleas such as *Xenopsylla cheopis* and *Ceratophyllus fasciatus*; pneumonic type spread from person to person by droplet infection.

Pasteurella pseudotuberculosis

(*Bacterium pseudotuberculosis rodentium*) — Causes septicemia in rodents; occasionally isolated from man but not the cause of a specific human infection; very similar to *Pasteurella pestis*.

Pasteurella tularensis

(*Bacterium tularense*; *Bacillus tularensis*) — The cause of tularemia (rabbit fever, deerfly fever) in man, rodents and other animals; man usually contracts infection by handling infected animals; also transmitted by ticks of the genus *Dermacentor*, biting flies of the genus *Chrysops* and other insects.

Proshigella

A proposed genus of organisms related to the *Shigella* and including anaerogenic "paracolon" types; organisms now known as *Shigella sonnei*, *Shigella dispar* and *Shigella alkalescens* are included in this group.

Proteus

A genus of gram-negative, non-sporogenous, rod-shaped bacteria widely distributed in putrefying materials; commonly found in stool cultures; of no special medical significance when isolated except under conditions where other infective agents can be ruled out; sometimes causes cystitis, pyelitis or abscess formation. The species include:

Proteus mirabilis

(*Bacillus mirabilis*; *Bacterium mirabile*) — Common in putrefying materials.

Proteus morganii

(*Bacillus morganii*; *Bacterium morganii*; *Salmonella morganii*) — “Morgan’s bacillus”; found in normal and in diarrheal stools; pathogenicity lacking or feeble.

Proteus rettgeri

(*Bacterium rettgeri*; *Bacillus rettgeri*; *Eberthella rettgeri*; *Shigella rettgeri*) — Pathogenic for birds; probably has some pathogenicity for man but is found in normal stools also.

Proteus vulgaris

(*Bacillus proteus*; *Bacterium vulgare*; *Bacillus proteus vulgaris*) — The species most common in putrefying materials.

Proteus X

A group of organisms useful in the diagnosis of typhus fever, spotted fever and other rickettsial infections (Weil-Felix test) but having no causative relation to those diseases; strains designated as OX19, OX2, OXK and HXK have been used.

Pseudomonas

A genus of gram-negative, non-sporogenous, rod-shaped bacteria producing water-soluble pigments (blue, green or yellowish-green); common in water and soil; one species may cause pyogenic infections:

Pseudomonas aeruginosa

(*Bacterium aeruginosum*; *Bacillus pyocyaneus*; *Pseudomonas pyocyanea*; *Bacterium pyocyaneum*) — The “blue pus organism”, is of significance when isolated from suppurative lesions.

Salmonella

A large and important genus of gram-negative, non-sporogenous, rod-shaped bacteria, parasitic in man and animals; human types produce mild to severe infections, usually with typhoidal syndromes, in man and are weakly pathogenic for animals; animal types are most virulent for the young of both animals and man (adults comparatively resistant); animal types infecting man usually cause acute gastro-enteritis (“food-poisoning”) but may cause typhoidal illnesses, septicemia and meningitis; carriers (particularly man, fowl, rodents and hogs) are important sources of infection; widely distributed. The many species (serological types) include:

Salmonella choleraesuis

(*Bacillus suipestifer*, *Bacterium cholerae suis*; *Salmonella suipestifer*) — Produces infections in young pigs resulting in adult carriers; formerly thought to be the cause of hog cholera; among animal types, one of the most pathogenic for man.

Salmonella hirschfeldii

(*Bacillus paratyphosus C*; *Bacterium hirschfeldii*; *Salmonella paratyphi-C*) — A human pathogen; an important cause of typhoidal infections (paratyphoid fever) but rarely found in the United States.

Salmonella kauffmannii

A species proposed to include all *Salmonella* except *Salmonella choleraesuis* and the typhoid organism; the many varieties would be designated by symbols indicating serological reactions.

Salmonella paratyphi

(*Bacterium paratyphi*; *Bacillus paratyphosus A*; *Salmonella paratyphi-A*) — A human pathogen; an important cause of typhoidal infections (paratyphoid fever); not frequent in the United States.

Salmonella schottmuelleri

(*Bacillus paratyphosus B*; *Salmonella paratyphi B*; *Bacterium schottmuelleri*) — A human pathogen (except possibly Java variety); an important cause of typhoidal infections (paratyphoid fever); common in the United States.

Salmonella typhimurium

(*Bacterium typhi murium*; *Bacterium aertrycke*; *Bacillus pestis-caviae*; *Salmonella aertrycke*) — The most widespread animal type; produces infections with resulting carriers among many animals including fowl and rodents; usually transmitted to man through contaminated food; an important cause of gastro-enteritis in man and of more severe illnesses in infants and children; ubiquitous among animals.

Salmonella typhosa

(Recently known as *Eberthella typhosa*; also as *Bacillus typhosus* and *Bacterium typhi*) — The cause of typhoid fever in man; spread through food and water contaminated by feces or urine from cases or carriers; contamination may be fly-borne.

Sarcina

A genus of gram-positive cocci characteristically occurring in groups of flat-sided packets; commonly found on skin surfaces, mucous membranes and the conjunctiva; may occasionally invade tissues to produce a pyogenic infection.

Serratia

A genus of gram-negative, non-sporogenous, rod-shaped bacteria usually producing a red pigment at atmospheric temperatures; predominantly saprophytic although pathogenic for cold-blooded animals; presence in specimens probably adventitious; of no medical significance.

Shigella

(*Dysenteroides*; *Castellanus*) — A genus of gram-negative, non-motile, non-sporogenous, rod-shaped bacteria commonly known as the "dysentery group". Species of medical importance include:

Shigella alkalescens

(*Bacillus alkalescens*; *Bacterium alkalescens*; *Eberthella alkalescens*; *Proshigella alkalescens*) — Ordinarily non-pathogenic except possibly under unusual conditions; frequently found in normal stools.

Shigella ambigua

(*Bacillus ambiguus*; *Bacterium ambiguum*; *Eberthella ambigua*; *Bacterium schmitzii*; *Shigella schmitzii*) — A cause of dysentery in man; includes the Schmitz type and related indole-forming, non-mannitol-fermenting dysentery organisms; not common in Connecticut.

Shigella dispar

(*Bacillus dispar*; *Eberthella dispar*; *Proshigella dispar*) — Ordinarily non-pathogenic except possibly under unusual conditions; found in the intestinal tract; usually of no medical significance unless isolated from the blood stream or from catheterized urine.

Shigella dysenteriae

(*Bacillus dysenteriae*; *Bacterium dysenteriae*; *Eberthella dysenteriae*) — A cause of dysentery in man; includes the Shiga and related types of non-indole-forming, non-mannitol-fermenting dysentery organisms; not common in Connecticut.

Shigella paradysenteriae

(*Bacterium flexneri*; *Bacterium paradysenteriae*; *Eberthella paradysenteriae*) — A cause of dysentery in man; includes all Flexner, Boyd and related types of mannitol-fermenting, non-lactose-fermenting dysentery organisms; endemic in Connecticut.

Shigella sonnei

(*Bacterium sonnei*; *Shigella paradysenteriae* var *sonnei*; *Proshigella sonnei*) — A cause of dysentery in man; the Sonne or Duval-Sonne type; endemic in Connecticut.

Spirillum

A genus of spiral bacteria; saprophytes of no medical importance except when confused with pathogenic forms.

Staphylococcus

A large genus of gram-positive cocci growing characteristically in irregular clusters; commonly present on normal skin and mucous membranes but probably the most common cause of boils, carbuncles, furunculosis, suppuration in wounds and other pyogenic infections; infected wounds may give rise to bacteremia; certain strains of staphylococci growing in food, particularly "cream-filled" pastry and meats, give rise to enterotoxins which cause food-poisoning.

Streptobacillus moniliformis

(*Haverhillia moniliformis*; *Actinomyces muris-ratti*) — A species of bacterium of uncertain position causing infections following bites of rats and other rodents; thought to be the cause of "Haverhill fever".

Streptococcus

A large genus of gram-positive cocci growing characteristically in chains; many species, both pathogenic and non-pathogenic: the characteristic reaction most commonly employed in medical bacteriology for rough grouping is the reaction on blood which subdivides the genus as follows:

(1) Beta hemolytic streptococci

The most common species in man is *Streptococcus pyogenes* (*Streptococcus hemolyticus*), containing Group A precipitinogen of Lancefield. (Many serological subtypes may be identified in Group A by agglutination tests.) Any given individual may harbor these organisms without clinical symptoms. The control of these

"healthy" carriers is impracticable in the general population. Certain beta hemolytic strains with toxicogenic properties are capable of inducing severe sore throat or scarlet fever in non-immunes. To the best of our knowledge, these toxicogenic strains are of Lancefield's Group A (human types) although they may be transmitted from a milker to a cow inducing an udder infection and thence be spread to a number of consumers drinking the milk raw. Erysipelas is another disease caused by beta hemolytic types. Cellulitis, acute follicular tonsillitis, pneumonia, puerperal fever, urinary tract infections, meningitis, wound infections and bacteriemia may be caused by beta hemolytic streptococci as the result of lowered resistance of the patient, as the result of trauma or other damage to tissues or perhaps as the result of enhanced virulence of any given strain.

(2) Alpha hemolytic (viridans or green producing types), non-hemolytic and other streptococci

Certain types may cause low-grade infections which are established in foci giving rise to chronic or subacute infections of the viscera. Subacute bacterial endocarditis and certain cases of arthritis may be caused by these types. Many authorities consider that rheumatic fever may likewise be listed in this group. Bagen has considered an organism similar to or identical with *Streptococcus bovis* to be the cause of ulcerative colitis but this is not thoroughly substantiated. Anaerobic types usually hemopeptolytic, are frequently associated with deep abscesses, gangrenous infections, appendicitis, puerperal sepsis and other infections. *Streptococcus salivarius*, *Streptococcus bovis*, *Streptococcus fecalis*, *Streptococcus liquefaciens*, *Streptococcus anaerobius*, *Streptococcus fetidus*, *Streptococcus putridus*, *Streptococcus lanceolatus*, *Streptococcus micros*, *Streptococcus parvulus*, *Streptococcus intermedius*, *Streptococcus evolutus* and numerous other less well-defined species are members of these groups of streptococci. All are widely distributed in nature and are frequently present on normal skin surfaces and mucous membranes or in the intestinal tract.

Treponema

A genus of spirochetes including two species of medical importance and a few others of no significance although often found on mucous membranes. Pathogenic species are:

Treponema pallidum

(*Spirocheta pallidum*) — The cause of syphilis.

Treponema pertenue

(*Spirocheta pertenue*) — The cause of yaws (fram-besia), a disease of the tropics.

Veillonella

A genus of small, gram-negative, anaerobic cocci similar to *Neisseria*; normally harmless parasites in the mouth and digestive tract of man; occasionally associated with abscesses or ulcerative lesions.

Vibrio

A genus of spiral bacteria; usually harmless water forms; one species pathogenic for man:

Vibrio comma

(*Spirillum cholerae asiaticae*; *Vibrio cholerae*) — The cause of Asiatic cholera; spread through feces of cases and carriers; usually water borne; not endemic in the United States.

II. RICKETTSIAL ORGANISMS**Bartonella bacilliformis**

A small organism similar to *Rickettsia* occurring in the red blood cells and sometimes in endothelial cells of individuals suffering from bartonellosis (Verruga peruana, Oroya fever, Carrion's disease); transmitted by sand flies of the genus *Phlebotomus*; found in Peru, Columbia and Ecuador.

Rickettsia

A genus of minute, bacteria-like organisms somewhat larger than the largest filterable viruses; certain species cause specific types of typhus fever and typhus-like diseases*; insect, tick or mite vectors transmit the various types to man; the several species have special geographical distributions. These include:

*"Kenya typhus" and South African tick-bite fever are closely related to boutonneuse fever; all are of the spotted fever type. "Indian tick typhus" and "Bullis fever" of Texas are probably rickettsial diseases but their exact position is not sure.

Rickettsia burneti

(*Rickettsia diaporica*) — The cause of Q fever, a disease described among abattoir workers in Australia and among laboratory workers studying *Rickettsia* in the United States; found in several species of ticks in both countries including *Dermacentor andersoni* and *Amblyomma americanum*.

Rickettsia conori

The cause of a disease similar to Rocky Mountain spotted fever and known variously as boutonneuse fever, Marseilles fever, fièvre exanthématique and fièvre escharonodulaire; transmitted by a dog tick, *Rhipicephalus sanguineus*.

Rickettsia mooseri

(*Rickettsia prowazeki* var. *mooseri*) — The cause of murine typhus, sometimes called endemic typhus or American typhus, which is identical with tabardillo or Mexican typhus; found in nature in rodents, particularly rats; transmitted from rat to rat by fleas and lice and from rat to man by fleas, particularly *Xenopsylla cheopis*; may be transmitted from man to man by lice in louse-infested communities; worldwide in distribution; present in the United States, especially in the South.

Rickettsia orientalis

The cause of tsutsugamushi disease or "scrub typhus" (Keldani fever, Japanese river fever, flood fever); found in nature in rodents; transmitted to man by mites, particularly *Trombicula akamushi* and *Trombicula deliensis*; found in Japan, southeastern Asia and the islands extending southward to Australia; not found in the United States.

Rickettsia prowazeki

(*Rickettsia prowazeki* var. *prowazeki*) — The cause of classical epidemic typhus fever of which Brill's disease is considered an imported variety; transmitted from man to man by lice (*Pediculus*); chiefly found in Europe; foci in Russia and the Balkans; occurs in the United States as Brill's disease, usually in seaport areas.

Rickettsia quintana

(*Rickettsia wolhynica*) — The probable cause of trench fever (Wolhynian fever); transmitted by the body louse; it is thought to be confined to Europe.

Rickettsia rickettsi

(*Derma-centroxenus rickettsi*) — The cause of Rocky Mountain spotted fever (eastern and western types) with which "Sao Paulo typhus" is identical; may be transmitted by several species of ticks, especially *Derma-centor andersoni*, *Derma-centor variabilis* and *Amblyomma cajennense*; infects succeeding generations of ticks through the eggs; common in tick infested areas of the United States.

III. FUNGI:**MOLDS AND YEASTS****Absidia**

A genus of fungi (molds) similar to *Mucor*; probably saprophytic but may produce mycosis; distribution worldwide.

Achorion

A genus of dermatophytic fungi producing favus; similar to *Trichophyton*. The species include:

Achorion schoenleini

(Many synonyms including *Trichophyton schoenleini* and *Grubyella schoenleini*) — The most common cause of favus.

Acladium

A genus of fungi (molds) infrequently encountered in infections of man.

Acremoniella

A genus of predominantly saprophytic fungi (molds); rarely associated with infection.

Acremonium

A genus of fungi (molds) rarely associated with mycotic infections.

Acrothecium

A genus of fungi (molds) of questionable pathogenicity.

Actonia

A genus of fungi (molds) that has been associated with throat infections and infections of the bronchi and bronchioles; described from Mesopotamia.

Aleurisma

A genus of predominantly saprophytic fungi (molds), rarely parasitic.

Allescheria

A genus of fungi (molds); usually saprophytic but in very rare instances may infect man, probably as a result of trauma or as a secondary invader; distribution worldwide.

Alternaria

A genus of fungi (molds) of very doubtful pathogenicity.

Aspergillus

A genus of fungi (molds); usually saprophytic but somewhat pathogenic for birds; may occasionally infect man, probably following trauma or as a secondary invader; distribution worldwide.

Asporomyces

A genus of yeast-like fungi of doubtful pathogenicity.

Ateleothylax

A genus of fungi (molds) involved in scalp and skin infections.

Atelosaccharomyces

A genus of yeast-like fungi similar to *Cryptococcus*, occasionally causing infections in man.

Blastocystis hominis

A non-pathogenic fungus (mold) found frequently in stools; of importance only because the blastocysts may be mistaken for amebae or other protozoa by the inexperienced.

Blastodendrion

A not too well delineated genus of yeast-like fungi isolated from mycotic infections of man.

Candida

A genus of yeast-like fungi occasionally found in mycotic infections, usually pulmonary, in man; includes some of the species usually described as *Monilia*.

Castellania

A genus of predominantly saprophytic, yeast-like fungi, generally only weakly pathogenic for man.

Catenularia

A genus of fungi (molds) infrequently encountered in infections of man.

Cephalosporium

A genus of fungi (molds) infrequently encountered in infections of man.

Chalara

A seldom found genus of fungi (molds); rarely found in lesions resembling sporotrichosis.

Coccidioides immitis

(*Oidium coccidioides*; *Mycoderma immitis*; *Zymonema immitis*) — A species of fungus (mold) causing coccidioidomycosis known in some forms as coccidioidal granuloma and as "Valley fever"; spread usually by inhalation of spore-contaminated dust; endemic in the southwestern United States.

Coniosporium

A genus of fungi (molds) isolated in Italy from onychomycosis in man.

Corethropsis

A genus of fungi (molds) infrequently encountered in infections of man.

Cryptococcus

(*Torula*) — A genus of yeast-like fungi including some which have repeatedly been involved in "torulosis" of man. The species include:

Cryptococcus histolyticus

(*Torula histolytica*; *Torulopsis histolytica*) — A common cause of meningeal infections in man.

Debaryomyces

A genus of yeasts reported from varied infections of man.

Dematium

A genus of fungi (molds); predominantly saprophytic but occasionally found in mycotic infections of man.

Diplosporium

A genus of fungi (molds) of questionable pathogenicity.

Ectotrichophyton

A genus of dermatophytic fungi producing lesions of the glabrous skin, the scalp and the nails; includes most of the kerion producing forms and many producing sycosis.

Endodermophyton

A genus of dermatophytic fungi causing tropical ringworms (*tinea imbricata*); not common in temperate climates.

Epidermophyton

A genus of dermatophytic fungi growing as parasites only in the horny layer of the epidermis; prevalent in temperate climates. The species include:

Epidermophyton interdigitale

(*Trichophyton interdigitale*) — A common species producing macerated or dysidrosiform lesions in the interdigital spaces commonly termed "athletes' foot"; found in the stratum corneum of the epidermis.

Eutorula

A genus of yeast-like fungi similar to *Cryptococcus* occasionally causing infections in man.

Favotrichophyton

A genus of dermatophytic fungi producing *tinea barbae*, *tinea tonsurans*, and *tinea capitis* and sometimes forming kerions in man; animal species of this genus usually do not infect man.

Fusarium

A genus of fungi (molds) containing important parasites of plants; species reported as pathogenic for animals and man have been inadequately defined.

Geotrichum

A genus of predominantly saprophytic, yeast-like fungi occasionally found in mycotic infections of man.

Gomphinaria

A genus of predominantly saprophytic, rarely encountered fungi (molds); rarely pathogenic.

Gymnoascus gypseus

(*Achorion gypseum*; *Sabouraudites gypseus*) — A species of fungus (mold); a cause of favus.

Hanseniospora

A genus of fungi (molds) rarely associated with mycosis.

Hansenula

A genus of fungi (molds) of doubtful pathogenicity.

Haplographium

A genus of fungi (molds) infrequently encountered in infections of man.

Hemispora

A genus of yeast-like fungi infrequently encountered in mycoses; possibly including organisms formerly classed in the genus *Bargellinia*.

Histoplasma

A genus of fungi (molds) causing generalized mycosis.

Hormodendron

A genus of fungi (molds) to which have been assigned certain pathogenic species producing sporotrichoid lesions.

Hyalopus

A genus of fungi (molds) infrequently encountered in infections of man.

Indiella

A genus of fungi (molds) rarely causing white grained maduromycosis; reported from India only.

Madurella

A genus of fungi (molds) causing maduromycosis (black grained mycetoma), an infection, usually of the feet, following wounds from thorns or other sharp objects; reported from India, North Africa, Italy and Greece and rarely from the American continent.

Malassezia

(*Pityrosporum*) — A genus of yeast-like fungi; obligate parasites confined to outer layers of the epidermis and the sebaceous glands. The species include:

Malassezia furfur

(*Microsporon furfur*; *Sporotrichum furfur*; *Oidium furfur*; *Oidium subtile*; *Monilia furfur*) — The organism of pityriasis versicolor (tinea versicolor).

Malassezia ovalis

(*Saccharomyces ovalis*; *Saccharomyces sphericus*; *Saccharomyces capillitii*; *Microsporum malassezi*; *Pityrosporum malassezi*; *Pityrosporum ovale*; *Cryptococcus ovalis*; *Cryptococcus capillitii*; *Cryptococcus malassezi*; *Torulopsis ovalis*; *Saccharomyces cantliei*) — This organism, sometimes called Unna's bottle bacillus (*Flaschenbacillus*), is frequently, perhaps universally, present in seborrheic conditions but its causative role is questionable.

Megatrichophyton

A genus of dermatophytic fungi causing, in man, lesions usually confined to the beard.

Microsporum

A genus of dermatophytic fungi producing the small-spored ringworms of man and animals usually affecting the scalp but sometimes the glabrous skin in man. The species include:

Microsporum audouini

Common in man; produces prepubertal tinea tonsurans.

Microsporum canis

Originally described from dogs; produces tinea tonsurans and herpes circinata in man, both children and adults.

Microsporium felineum

Common among cats; in man, may occur on the scalp but prefers glabrous skin, sometimes producing kerions.

Monilia

A genus of predominantly saprophytic, yeast-like fungi having little if any pathogenicity for man; formerly included forms frequently encountered in thrush ("*Monilia albicans*") and a species thought to cause sprue ("*Monilia psilosis*"), both of which are now listed under *Syringospora*.

Monosporium

A genus of fungi (molds) infrequently encountered in infections of man.

Mortierella

A genus of fungi (molds); usually saprophytic but in very rare instances may cause mycosis, probably following trauma or as a secondary invader; not important medically; distribution worldwide.

Mucor

A genus of fungi (molds); usually saprophytic but in very rare instances may cause mycosis, probably following trauma or as a secondary invader; not important medically; distribution worldwide.

Mycocandida

A genus of yeast-like fungi reported from mycotic infections of man.

Mycoderma

A genus of predominantly saprophytic, yeast-like fungi occasionally encountered in mycotic infections in man.

Mycotoruloides

A genus of yeast-like fungi reported from mycotic infections of man.

Octomyces

A poorly defined genus of yeast-like fungi infrequently encountered in pulmonary mycoses.

Paracoccidioides brasiliensis

(*Coccidioides brasiliensis*) — A species of fungus (mold) similar in many ways to *Coccidioides immitis* but differing in morphological detail and having its main portal of entry through the intestine.

Parasaccharomyces

A genus of yeast-like fungi associated with mycotic infections of man.

Parendomyces

A poorly defined genus of yeast-like fungi isolated from infections of man, usually of the mucous membranes.

Penicillium

A genus of fungi (molds); saprophytic but has rarely been reported in mycetomas; of great commercial importance; of medical importance for the manufacture of antibiotics (e.g., penicillin from *Penicillium notatum*); distributed worldwide.

Phaeoscopulariopsis

A genus of fungi (molds); probably saprophytic but have been isolated from abscesses in man.

Phialophora

A genus of fungi (molds) infrequently encountered in infections of man.

Piedraia

(*Trichosporum*) — A poorly defined genus of fungi (molds) causing the formation of hard nodules ("piedra") surrounding the shafts of hair; occur principally in tropical regions, especially where there is a lack of personal hygiene.

Proteomyces

A poorly defined genus of yeast-like fungi isolated from mycoses of man.

Pseudomonilia

A genus of yeast-like fungi reported from mycotic infections of man.

Pseudomycoderma

A genus of yeast-like fungi occasionally encountered in mycotic infections, usually pulmonary, of man.

Pullularia

A genus of fungi (molds) infrequently associated with mycetoma or other lesions of man.

Redaellia

A genus of yeast-like fungi of doubtful pathogenicity.

Rhinosporidium seeberi

A sporulating fungus (mold) found sometimes as the etiological agent in nasal polyps.

Rhizopus

A genus of fungi (molds); usually saprophytic but in very rare instances may cause mycosis, probably following trauma or as a secondary invader; not important medically; distribution worldwide.

Saccharomyces

A genus of yeasts including species used in baking and brewing; some species have been isolated from infections in man.

Schizoblastosporion

A seldom encountered genus of yeast-like fungi reported from lesions of the skin and nails.

Scopulariopsis

A genus of fungi (molds) very similar to *Penicillium*; usually saprophytic but has been reported in onychomycosis and other mycotic infections; worldwide in distribution.

Spicaria

A genus of predominantly saprophytic fungi (molds) containing forms isolated rarely from lesions of man which have tentatively been assigned to this group.

Spondylocladium

A genus of fungi (molds) infrequently isolated from sporotrichoid lesions.

Sporotrichum

A genus of predominantly saprophytic fungi (molds) which contains at least one pathogenic species causing serious infections:

Sporotrichum schenki

(*Sporothrix schenki*; *Rhinocladium schenki*; *Rhinotrichum schenki*; *Sporotrichum beurmanni*; *Sporotrichum councilmani*) — A cause of sporotrichosis.

Syringospora

A genus of yeast-like fungi including forms which commonly cause thrush and some which cause infections commonly called moniliasis. The species include:

Syringospora albicans

(*Monilia albicans*; *Oidium albicans*; *Endomyces albicans*; *Mycotorula albicans*) — The most common cause of thrush.

Syringospora interdigitalis

(*Cryptococcus interdigitalis*; *Mycotorula interdigitalis*) — Isolated from interdigital lesions.

Syringospora psilosis

(*Monilia psilosis*; *Mycotorula psilosis*; *Candida psilosis*) — Formerly believed to be the cause of sprue.

Thomiella

A genus of fungi (molds) infrequently encountered in infections of man.

Torulopsis

A genus of yeast-like fungi similar to *Cryptococcus*, occasionally causing infections in man.

Trichophyton

A genus of dermatophytic fungi causing tinea tonsurans and sometimes lesions of the glabrous skin. The species include:

Trichophyton tonsurans

The most common cause of ringworm of the scalp of the "Malmstenia" type, a prepubertal infection.

Trichophyton sabouraudi

(*Trichophyton acuminatum*) — A common cause of ringworm of the scalp of the "Sabouraudia" type.

Trichosporium

A genus of fungi (molds) rarely associated with mycotic infections.

Zymonema

(*Blastomyces*; *Blastomycoides*; *Gilchristia*; *Cryptococcus*)
—A genus of yeast-like fungi causing blastomycosis (cutaneous, pulmonary or generalized). The principal species is:

Zymonema dermatitidis

(*Cryptococcus gilchristi*; *Blastomyces hominis*; *Saccharomyces hominis*; *Mycoderma dermatitidis*; *Oidium hektoenii*; *Zymonema gilchristi*) — The common cause of blastomycosis in man.

IV. PARASITIC PROTOZOA

Balantidium

A genus of parasitic protozoa (ciliates); one species parasitic in man widely distributed geographically. The following species are included:

Balantidium coli

A ciliated protozoan parasite which parasitizes man and is common in hogs; in man, penetrates into the mucosa and submucosa of the intestine carrying bacteria into the tissues and causing abscesses which rupture into the intestine; produces a chronic dysentery which has been known to result fatally; usually spread through ingestion of food or other material contaminated with feces containing the cysts, resistant resting stage, of the parasite; infrequently found in Connecticut.

Balantidium minutum

An apparently rare species; of no practical importance; not found in Connecticut.

Chilomastix mesnili

A common intestinal protozoan parasite (flagellate), probably not pathogenic; occurs in the large intestine; its cysts (resistant resting stage) are demonstrable in the feces; occasionally found in Connecticut.

Dientameba fragilis

A fragile parasitic ameba which is not known to form cysts and which disintegrates rapidly in the feces; commonly regarded as non-pathogenic but has been reported to cause a dysentery; probably more widespread than generally believed but is seldom seen because of difficulties in demonstrating its presence.

Eimeria stiedae

(*Coccidium cuniculi*; *Coccidium oviforme*; *Eimeria gubleri*) — A protozoan parasite (coccidium) very common in rabbits and rare in man; in man, attacks the liver; has a life cycle similar to that of the malarial parasite but it is not a blood parasite and does not require an intermediate host; oöcysts may be found in the feces of infected individuals; has not been reported in man from Connecticut and fewer than ten human cases have ever been reported.

Endameba

(*Entameba*) — A genus of protozoa (amebae) parasitic in man; species that inhabit the intestine are transmissible in the encysted (resistant resting) stage only. The following species are included:

Endameba coli

(*Entameba coli*) — Not pathogenic; a commensal parasite of the human intestine; common in Connecticut.

Endameba gingivalis

(*Entameba gingivalis*) — Probably not pathogenic; a saprophytic species living in the mouth, especially in pyorrheal pockets where the bacterial food supply is abundant; probably does not form cysts.

Endameba histolytica

(*Entameba histolytica*) — The pathogenic ameba of importance; the cause of acute amebic dysentery and of chronic amebiasis; produces necrotic ulcerations of the large intestine often accompanied by secondary bacterial infection; may invade the liver; chronic infection has been known to persist for 30-40 years; transmission of the cysts usually occurs through food or water contaminated directly by feces or indirectly by food handlers or flies; present but not widespread in Connecticut.

Endolimax nana

A non-pathogenic ameba; a commensal parasite of the human intestine; common in Connecticut.

Enteromonas hominis

(*Tricercomonas intestinalis*) — A rare protozoan parasite (flagellate) of man; of little practical significance; cysts (resistant resting stage) are formed; has not been found in Connecticut.

Giardia lamblia

(*Lamblia intestinalis*; *Giardia enterica*) — The most common of the flagellated protozoan parasites of man; localizes in the small intestine; forms cysts (resistant resting stage) which are demonstrable in feces; probably has feeble, if any, pathogenicity but has been associated with diarrhea; similar, possibly identical parasites occur in mice, rats and other animals; common in Connecticut.

Iodameba butschlii

(*Iodameba williamsi*) — A probably non-pathogenic ameba; common in hogs and found in monkeys and man; a commensal parasite of the intestine; infrequent as a parasite of man in Connecticut.

Isospora hominis

(*Isospora belli*) — A protozoan parasite (coccidium) feebly pathogenic for man, has a life cycle similar to that of the malarial parasite but is not a blood parasite and does not require an intermediate host; oöcysts may be found in the feces of infected individuals. Most human cases have been reported from the eastern Mediterranean region; not reported from Connecticut.

Leishmania

A genus of parasitic protozoa related to the genus *Trypanosoma*; has a definite life cycle requiring an intermediate insect host; may also be transmitted from man to man; species not well delineated and are differentiated chiefly upon epidemiological, pathological or clinical grounds. These include:

Leishmania braziliensis

The cause of the American type of leishmaniasis variously called mucocutaneous leishmaniasis, espundia, uta or bubas; indolent ulcerating cutaneous lesions occur and involvement of mucous membranes may re-

sult in extensive necrosis of the nose, mouth and pharynx; transmitted by direct contact and very probably through the bite of sand flies of the genus *Phlebotomus* or of other insects; reported from South America, Central America and Mexico.

Leishmania donovani

The cause of a generalized leishmaniasis, kala-azar; localizes in endothelial cells of various tissues but may be present in phagocytic cells of the circulating blood; transmission by droplet infection is possible but the more probable vector is some biting insect, presumably sand flies of the genus *Phlebotomus*; occurs in southern Asia, Mediterranean Europe, northern Africa and central Africa; does not occur in the western hemisphere.

Leishmania infantum

The cause of "infantile kala-azar", the form of generalized leishmaniasis most frequently seen along the Mediterranean littoral where children are the ones usually attacked; probably identical with *Leishmania donovani*.

Leishmania tropica

The cause of a cutaneous leishmaniasis usually called oriental sore or Delhi boil; transmission may be direct but the sand flies of the genus *Phlebotomus* are probable vectors; occurs in India, North Africa, Asia Minor, Syria, Persia, Arabia and along the Mediterranean littoral; considered different from *Leishmania braziliensis*.

Nyctotherus faba

A rare protozoan parasite (ciliate) reported only once from man.

Plasmodium

A genus of blood parasites including the four species which produce malaria in man; human malarial parasites have a complicated life cycle, one phase of which takes place in mosquitoes (*Anopheles*); female anopheline mosquitoes that have sucked blood from a malarial patient become infectious after about 8-10 days and are capable of transmitting the parasites to man in the act of "biting". The species parasitic in man follow:

Plasmodium falciparum

The cause of "malignant tertian" or "estivo-autumnal" malaria; sometimes causes "blackwater fever"; the most dangerous malarial parasite but not endemic in Connecticut.

Plasmodium malariae

The cause of "quartan" malaria, often resistant to treatment and prone to late relapses, has been endemic in Connecticut.

Plasmodium ovale

Similar in appearance to *Plasmodium vivax* but confined principally to West Africa; not reported from the United States.

Plasmodium vivax

The most widespread of the malarial parasites; the cause of "benign tertian" malaria.

Retortamonas intestinalis

(*Embadomonas intestinalis*) — A rare protozoan parasite (flagellate) of man; of little practical significance; cysts (resistant resting stage) are formed; has not been found in Connecticut.

Sarcocystis

A genus of protozoan parasites of many mammals, occasionally of birds and rarely of man; found within the striated muscle fibers; has not been found in man in Connecticut.

Toxoplasma

A genus of organisms thought to be allied to the malarial parasites; have been reported from meningo-encephalitis of man.

Trichomonas

A genus of flagellated protozoan parasites, common in man; widely distributed geographically. The following species are included:

Trichomonas hominis

(*Trichomonas intestinalis*) — A parasite of the large intestine, often associated with diarrheal conditions but probably non-pathogenic; cysts have not been found; common in the United States but usually seen only in fresh stools.

Trichomonas vaginalis

Parasitic on the genital mucosa, particularly the vagina; cysts have not been found; may cause acute vaginitis with profuse leucorrheal discharge; usually associated with lack of personal hygiene; has been found in Connecticut but there is no exact knowledge of its prevalence.

Trypanosoma

A genus of flagellated protozoa parasitic in the blood of man and animals; species pathogenic for man require an intermediate insect host and are usually found only in tropical and subtropical areas; have a complicated life cycle. Species pathogenic for man include:

Trypanosoma cruzi

(*Schizotrypanum cruzi*) — The cause of Chagas' disease (American trypanosomiasis); transmitted through fecal material of insects, usually of the genera *Triatoma* and *Rhodnius* of the family *Reduviidae* (cone-nosed bugs); not transmissible from man to man; occurs in man in Central and South America, occasionally in Mexico, and has been observed in insects in Arizona, California, New Mexico, Texas and Utah.

Trypanosoma gambiense

One of two species which cause African trypanosomiasis (sleeping sickness); transmitted by the bite of tsetse flies, *Glossina palpalis* and probably *Glossina tachinoides*; wild animals probably constitute an important reservoir of infection; not transmissible from man to man; confined to the "tsetse fly belt" of Central Africa.

Trypanosoma rhodesiense

One of two species which cause African trypanosomiasis (sleeping sickness) and the more virulent of the two; transmitted by the bite of a tsetse fly, *Glossina morsitans*; wild animals and possibly domestic animals

probably constitute an important reservoir of infection; not transmissible from man to man; confined to relatively limited African areas in Rhodesia, Mozambique and Tanganyika.

V. TREMATODES (FLUKES)

Amphimerus

A genus of parasitic trematodes (flukes) rarely encountered in man.

Artyfechinostomum

A genus of parasitic trematodes (flukes) reported occasionally as incidental parasites of man.

"Cercaria elvae"

A larval form of a trematode (flake) with an unknown adult stage probably parasitic in birds; causes "swimmer's itch", a cercarial dermatitis in man; snails of the genera *Lymnea* and *Stagnicola* are intermediate hosts; found in the United States.

"Cercaria physellae"

A larval form of a trematode (flake) with an unknown adult stage probably parasitic in birds; causes "swimmer's itch", a cercarial dermatitis in man; snails of the genus *Physella* are intermediate hosts; found in the United States.

"Cercaria stagnicolae"

A larval form of a trematode (flake) with an unknown adult stage probably parasitic in birds; causes "swimmer's itch", a cercarial dermatitis in man; snails of the genus *Stagnicola* are intermediate hosts; found in the United States.

Clonorchis sinensis

(*Clonorchis endemicus*; *Opisthorcis sinensis*) — A liver fluke of man and other mammals; requires as intermediate hosts (1) snails mainly of the genera *Parafossarulus* and *Bithynia* and (2) freshwater fish including many species of the carp family; ingested with raw or incompletely cooked fish; common in Japan, China and adjacent areas; reported from oriental immigrants in the United States.

Dicrocoelium dendriticum

(*Dicrocoelium lanceatum*) — A parasite of sheep and cattle; requires at least one intermediate host, snails of the genera *Helicella*, *Cochlicella* and *Zebrina*; has been reported as a liver parasite from man in Syria, Lebanon, Turkestan and Europe; found in animals in North America.

Echinochasmus

A genus of parasitic trematodes (flukes) reported occasionally as incidental parasites of man.

Echinostoma

A genus of trematodes (flukes) parasitic in the intestine of man, mammals and birds. The species include:

Echinostoma ilocanum

(*Euparyphium ilocanum*; *Fascioletta ilocana*) — An intestinal parasite (trematode) of dogs, rats and man; requires two intermediate hosts, both fresh-water snails; ingested with snails (chiefly *Pila luzonica*) eaten raw; found in the Philippines and the southern Chinese port areas.

Euparyphium

A genus of parasitic trematodes (flukes) reported occasionally as incidental parasites of man.

Fasciola hepatica

(*Distomum hepaticum*) — Normally parasitic in sheep, goats and the like in which it causes a destructive "liver rot"; has a life cycle requiring an intermediate host, snails principally of the genera *Lymnea*, *Galba* and *Fossaria*; parasitizes man, usually as the result of ingesting encysted larval forms that attach themselves to vegetation after leaving the snail host, sometimes as the result of ingesting adult forms in raw liver from parasitized animals; reported from man in Europe, South America, China, Armenia, Hawaii, the West Indies, Turkestan and North Africa; parasitizes animals in the United States.

Fasciolopsis buski

(*Distomum crassum*) — An important trematode parasite of man; requires snails, mainly of the genera *Planorbis* and *Segmentina*, as intermediate hosts; ingested as encysted larvae with aquatic vegetation used as food; adult forms localize in the intestine of man or of pigs; most common in eastern and southeastern Asia and adjacent islands.

Gastrodiscoides hominis

(*Gastrodiscus hominis*; *Amphistomum hominis*) — A parasitic trematode (fluke) living in the intestine; probably a natural parasite of the pig which infects man only under special conditions; larval stages and intermediate hosts unknown; found in eastern India, Assam, Malay States and Cochin China, and imported from India into British Guiana.

Heterophyes heterophyes

(*Cotylogonimus heterophyes*) — An intestinal parasite (trematode) of man, cats and dogs; requires two intermediate hosts, (1) a snail (genus *Pirenella* in Egypt) and (2) a fresh-water fish of the mullet family; ingested with raw or insufficiently cooked fish of a type commonly salted for preservation as food; common in Egypt, Palestine, Japan, China, Korea, Formosa and the Philippines.

Himasthla

A genus of parasitic trematodes (flukes) reported occasionally as incidental parasites of man.

Metagonimus yokogawai

(*Loxotrema ovatum*) — A trematode (fluke) parasitic in the intestine of man, cats, dogs and pigs; requires two intermediate hosts, (1) a snail of the genus *Melania* and (2) fresh-water fish (a trout); ingested with raw fish; common in Japan, Korea, Formosa, Palestine, the Netherlands East Indies and the Balkans.

Monorchotrema

A genus of parasitic trematodes (flukes) similar to *Heterophyes* and seldom encountered in man.

Opisthorcis

A genus of trematodes (flukes) parasitic in man and animals. The species include:

Opisthorcis felineus

A liver parasite, normally of cats, dogs, foxes and pigs, occasionally of man; requires as intermediate hosts (1) snails of the genus *Bithynia* and (2) fresh-water fish such as bream, chub, carp, barbel and tench; ingested with raw or insufficiently cooked fish; reported in man from Siberia, eastern Germany and the Philippines.

Opisthorcis viverrini

Normally a parasite of the civet cat; has been found as a liver parasite of man in Siam (Thailand); ingested with raw fish.

Paragonimus westermani

(*Paragonimus ringeri*; *Paragonimus compactus*; *Distoma westermani*; *Distoma ringeri*; *Distoma pulmonale*; *Paragonimus kellicotti*) — The human lung fluke, occurring also in carnivorous animals, both wild and domestic; requires two intermediate hosts, (1) a snail of the genus *Melania* and (2) fresh-water crustaceans (crabs or crayfish); ingested with raw or incompletely cooked crustacean hosts; widespread geographically; found in cats and in mink in the United States.

Schistosoma

(*Bilharzia*) — A genus of trematodes (flukes) parasitic in the blood; characteristically require fresh-water snails as intermediate hosts; free-swimming larvae penetrate the skin of the human or animal host (or may be swallowed with water or food) and then develop to maturity; some species may penetrate the skin of unnatural hosts, bring about a dermatitis but fail to produce schistosomiasis (bilharziasis) because unable to develop further. Species included are:

Schistosoma bovis

A parasite of bovines; reported from man but apparently not well substantiated as a human parasite; found in Africa.

Schistosoma hematobium

(*Distoma hematobium*; *Bilharzia hematobium*) — An important parasite of man producing a schistosomiasis usually characterized by hematuria; intermediate hosts are snails, mainly of the genera *Bulinus*, *Physopsis* and *Planorbis*; eggs voided in urine and frequently in feces of infected individuals; widespread in Africa and has been found in southern Portugal, in Greece and in the islands of Cyprus, Madagascar, Mauritius and Reunion.

Schistosoma intercalatum

A parasite of man similar to *Schistosoma hematobium* but not producing hematuria; a snail, *Physopsis africana*, is a proven intermediate host; eggs voided only in feces; reported from the Belgian Congo.

Schistosoma japonicum

(*Schistosoma cuttoi*) — The cause of oriental schistosomiasis; snails mainly of the genera *Blanfordia* and *Hemibia* are intermediate hosts; eggs voided only in feces; common in Japan, China, Formosa and the Philippines.

Schistosoma mansoni

(*Schistosomum americanum*) — An important cause of schistosomiasis of man; intermediate hosts are snails mainly of the genera *Planorbis* and *Physopsis*; eggs voided only in feces; common in Africa and north-eastern Brazil and found in Venezuela, Dutch Guiana and many of the West Indies.

Schistosoma spindale

A parasite of bovines; reported in man as a cause of "swamp itch", a cercarial dermatitis similar to "swimmer's itch" and has been reported from the urine of man in two questionable cases of schistosomiasis in South Africa; snails of the genera *Planorbis* and *Bulinus* are intermediate hosts; found in India, Sumatra, Malay States and Africa.

Schistosomatium douthitti

(*Schistosoma douthitti*) — A parasitic trematode (fluke) causing "swimmer's itch", a cercarial dermatitis of man; normally a parasite of the meadow mouse; snails of the genera *Lymnaea* and *Physa* serve as intermediate hosts; common in North America.

Stamnosoma

A genus of parasitic trematodes (flukes) similar to *Heterophyes* and seldom encountered in man.

Trichobilharzia ocellata

A parasitic trematode (fluke) causing "swimmer's itch", a cercarial dermatitis of man; snails of the genus *Lymnaea* are intermediate hosts; found in North America and France.

Watsonius watsoni

An intestinal trematode (fluke); a rare, incidental parasite of man; probably a natural parasite of monkeys; larval stages and intermediate hosts unknown; reported from Africa.

VI. CESTODES (TAPEWORMS)

Bertiella

(*Bertia*) — A genus of cestodes (tapeworms) parasitic in monkeys and apes, occasionally in dogs and man; larval stage may occur in mites; usually found in the Tropics.

Digramma brauni

A cestode (tapeworm) parasitic in lower animals; reported twice from man in Romania.

Diphyllbothrium

A genus of cestodes (tapeworms) of considerable importance in medicine; adults occur in intestine of man, mammals, birds and reptiles; larvae develop in small crustacea which are ingested by fish; second larval stage encysts in muscles of fish (occasionally in man); infective second stage larvae ingested with raw or insufficiently cooked fish; distribution worldwide. The species include:

Diphyllbothrium cordatum

A natural parasite of dog, seal, walrus and bear; very occasionally of man; found in Greenland, Iceland and the Yellowstone Park area of the United States.

Diphyllbothrium erinacei

(*Diphyllbothrium mansonii*; *Diphyllbothrium reptans*; *Diphyllbothrium okumurai*; *Diphyllbothrium ranarum*; *Diphyllbothrium houghtoni*; *Diphyllbothrium decipiens*) — A cestode (tapeworm) which invades man in one of its larval stages producing inflammatory swellings and abscesses, occasionally ocular; apparently the principal cause of non-proliferating "sparganosis" in man; first stage larvae develop in minute crustaceans of the genus *Cyclops*; normally, second stage larvae develop in frogs, toads or snakes which feed upon the crustaceans; adult stage found in cats and dogs; when crustaceans are accidentally ingested by man the second larval stage development takes place in his tissues, giving rise to symptoms; found chiefly in the Orient but reported from the United States.

Diphyllbothrium latum

(*Tenia lata*; *Dibothriocephalus latus*) — The "broad Russian" or "fish" tapeworm, an important parasite of man; larvae go through first stage development in minute crustacea, mainly of the genera *Diaptomus*

and *Cyclops*; second stage of larval development occurs in tissues of fresh-water fish including pike, sand pike, wall-eyed pike and burbot; ingested with raw or insufficiently cooked fish; adults parasitize man and fish-eating mammals; widely distributed in temperate climates.

Diphyllbothrium mansonoides

A natural parasite of felines and occasionally dogs but second larval stage may produce non-proliferating "sparganosis" in man; first larval stage develops in minute crustacea of the genus *Cyclops*; second larval stage normally develops in mice and reptiles but has been found in monkeys and man; common in animals in the United States.

Diplogonoporis grandis

A cestode (tapeworm) parasite found naturally in the adult stage in whales, seals and marine birds, rarely in man; life history unknown; probably ingested with raw salt-water fish which serve as intermediate hosts; reported in man from Japan.

Dipylidium caninum

A species of cestode (tapeworm) normally parasitizing the dog but also found in man; larval stage passed in fleas or in the dog louse; ingested with fleas or dog lice; an accidental human parasite usually in children having close contact with dogs.

Drepanidoteia lanceolata

(*Hymenolepis lanceolata*) — A species of cestode (tapeworm) common in geese and ducks and reported once in man; passes its larval stage in minute crustaceans of the genera *Cyclops* and *Diaptomus*; accidental in man.

Echinococcus granulosus

(*Tenia echinococcus*) — A species of cestode (tapeworm) parasitic in the adult stage in dogs; the larval stage can develop in most mammals, producing hydatid cysts (echinococcosis) in man; ingested as eggs by man with food or water contaminated with feces from infected dogs; world-wide distribution.

Hymenolepis

A genus of cestodes (tapeworms) principally found in rodents and man; some species do not require intermediate hosts for larval development; distribution worldwide. The species include:

Hymenolepis diminuta

(*Tenia diminuta*) — A common parasite of rats, mice and other rodents and also found in man in rodent-infested areas; intermediate hosts for larval development include fleas, cockroaches and meal-eating insects; found worldwide.

Hymenolepis nana

(*Tenia nana*; *Hymenolepis fraterna*) — A common parasite of man, rats and mice; does not require an intermediate host but larvae can develop in fleas and certain beetles; ingested as eggs or as larvae in insects; distribution worldwide.

Inermicapsifer

A genus of cestodes (tapeworms) reported in man only from Cuba; life cycle unknown.

Ligula

A cestode (tapeworm) parasitic in lower animals; reported twice from man in Romania.

Mesocestoides

A genus of cestodes (tapeworms) parasitic in lower animals; one case in man reported from Texas.

Multiceps

A genus of cestodes (tapeworms) naturally parasites of dogs and other canines; larval stages (gids or bladderworms) develop in other animals, occasionally in man as the result of swallowing eggs in dog feces; rare in man.

Raillietina

(*Davainea*) — A genus of cestodes (tapeworms) common in birds, especially domestic fowl; larval stages found in insects, especially beetles; rarely found in man.

"Sparganum proliferum"

A larval tapeworm producing the proliferating "sparganosis" of man; adult stage and life history unknown; larvae probably ingested with water containing small crustacea or with raw frog or tadpole flesh; extremely rare in the United States.

Tenia

A genus of cestodes (tapeworms) containing species of importance to man: have larval (cysticercus) stages in the muscles of intermediate hosts: adults develop in intestine of man or animals after ingestion of meat containing cysticerci; distribution worldwide. The species include:

Tenia saginata

The "beef tapeworm", the common "unarmed" tapeworm of man; cysticerci develop in cattle and are ingested with raw or insufficiently cooked beef; distribution worldwide.

Tenia solium

The "pork tapeworm", the common "armed" tapeworm of man; cysticerci develop normally in pigs, less commonly in man after swallowing eggs with feces-contaminated food or water; adults occur only in man after ingestion of cysticerci with raw or insufficiently cooked pork.

VII. PARASITIC NEMATODES (ROUNDWORMS)**Acanthocheilonema perstans**

A filarial parasite of man, apes and monkeys; adult worms live in body cavities, particularly the peritoneum, but produce no specific symptomatology; microfilarial larvae do not exhibit any periodicity of appearance in the blood; the intermediate hosts are blood-sucking flies of the genus *Culicoides*; found in Africa, South America and New Guinea.

Ancylostoma

(*Ancylostoma*; *Ankylostomum*) — A genus of hookworms; eggs passed in the feces develop into infective filariform larvae which bore through the skin, enter the lymphatics and circulatory system, are carried to the lungs,

eventually crawl up the trachea and are swallowed; unlike *Strongyloides*, the free-living forms never mature sexually and development from one generation to another cannot take place entirely within the host; common in warm moist climates around the world.

Ancylostoma braziliense

(*Ancylostoma ceylanicum*) — A common hookworm parasite of animals, particularly cats and dogs; in man, seldom produces hookworm disease but does produce the dermatitis known as “creeping eruption” or “larva migrans”; the latter condition occurs when infective larvae penetrate the skin of an unnatural host (man), are unable to penetrate below the stratum germinativum and wander in the skin to produce a serpiginous tunnel; common in tropical and subtropical climates.

Ancylostoma caninum

A common hookworm of the dog and cat; in man, may occasionally cause hookworm disease but can cause the “creeping eruption” or “larva migrans” described above; most common in the warmer climates of the Northern Hemisphere.

Ancylostoma duodenale

The “Old World” hookworm of man, producing hookworm disease (ancylostomiasis); common in southern Europe, northern Africa, northern India, northern China and Japan; also found in Paraguay and has been spread into the southwest Pacific islands, adjacent areas of the Asiatic mainland and western Africa.

Ancylostoma malayanum

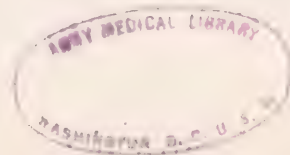
A large hookworm of species of bear, occasionally infesting man; found in India and the Malay States.

Anguillula dipsaci

(*Anguillula putrefaciens*) — A parasite of onions with which it may be ingested; not parasitic for man.

Ascaris lumbricoides

The common parasitic roundworm of man and of swine; infective embryos develop within eggs passed in feces; distribution worldwide.



Capillaria

A genus of trichurid worms parasitic in animals; one authentic case of liver parasitism in man reported from India.

Diectophyme renale

(*Eustrongylus gigas*) — The giant kidney worm of the dog and other animals, occasionally found in man; distribution in animals worldwide.

Dirofilaria

A genus of filarial worms found in animals and man; adults live in tissues or body cavities; microfilarial larvae circulate in the blood; intermediate hosts, probably mosquitoes, are required; reported in man from Brazil, Louisiana and Russia.

Dracunculus medinensis

(*Gordius medinensis*; *Vena medinensis*; *Filaria medinensis*; *Fuellebornius medinensis*) — The "guinea worm", a filaria-like parasite of man and lower animals, producing dracunculiasis (dracontiasis); the adult male lives in body cavities and connective tissue; the female, after fertilization, migrates to the subcutaneous tissues: and ulceration occurs where the head of the worm lies under the skin; through a rupture in the ulcer the female discharges larval forms whenever contact with water is made; the larval forms develop into infective larvae in small fresh-water crustaceans of the genus *Cyclops* which re-infect when swallowed by a suitable host; common in animals throughout the world; found in man frequently in Africa, Arabia, the Netherlands East Indies and India, infrequently in the United States.

Enterobius vermicularis

(*Oxyuris vermicularis*) — The common pinworm or "seat-worm" of man; the female characteristically deposits eggs in the perineal region at night; distribution worldwide.

Esophogastomum

A genus of strongylid worms containing species parasitic in apes, monkeys and man; infective larvae arising from eggs passed in stools must be swallowed before they can develop; found in the tropical belt around the world.

Gnathostoma

A genus of parasitic roundworms sometimes causing "creeping eruption" ("larva migrans") in man who is an unnatural host; adult worms not found in man in whom the larvae fail to develop further; adult stage passed in animals, larval stages in fresh-water crustaceans and fish; found mainly in east Asia.

Gongylonema

A genus of thread-like worms parasitic in animals and occasionally in man in whom it inhabits the mucosa and submucosa of the lips and oral cavity; requires an intermediate host (dung-beetles and cockroaches) for development of infective larvae; worldwide distribution.

Hemonchus contortus

The most common helminth parasite of domestic sheep, common in other herbivores and occasionally found in man; reported in man from Brazil and Australia; common in sheep in the United States.

Heterodera marioni

(*Heterodera radiculicola*) — A common plant parasite sometimes ingested with vegetables and passed in the feces; not parasitic for man.

Lagochilascaris minor

An ascarid worm, naturally parasitic in the cloudy leopard; has been known to produce subcutaneous, tonsillar and mastoid abscesses in man; found in Trinidad and Dutch Guiana.

Loa loa

(*Filaria oculi humani*; *Filaria lachrymalis*; *Filaria oculi*; *Filaria subconjunctivalis*; *Microfilaria diurna*) — A species of filarial worms producing filariasis in man characterized by "fugitive swellings", sometimes ocular; adult worms are subcutaneous parasites which migrate in the subdermal tissues; microfilarial larvae appear in the blood during the day only; microfilariae ingested by the intermediate host (biting flies of the genus *Chrysops*) develop into infective larvae which migrate to the proboscis ready for re-inoculation into man; restricted to tropical west Africa.

Mansonella ozzardi

(*Filaria ozzardi*; *Filaria demarquayi*; *Filaria tucumana*) — A filarial parasite of man; adult worms live in the body cavities; microfilarial larvae appear in the blood non-periodically; an intermediate host, probably blood-sucking flies of the genus *Culicoides*, is required; occurs in South America, Panama, Yucatan and the West Indies.

Mermithidae

A family of roundworms including the so-called "cabbage-snakes"; not parasitic in man but sometimes swallowed and passed in the feces where they have been mistaken for parasites.

Metastrongylus elongatus

(*Metastrongylus apri*) — A common bronchial parasite of pigs and wild boars, occasionally of other animals and of man in whom it has been found either in the respiratory tract or in the intestine; distribution worldwide.

"Microfilaria"

(*Filaria*; *Agamofilaria*) — Used as a genus name when the adult forms of certain filarial worms are unknown and only microfilarial larvae are found in the host; a number of these have been described in man.

Necator americanus

(*Uncinaria americana*; *Ankylostomum americanum*; *Necator africanus*; *Necator argentinus*) — The "New World" or "American" hookworm of man, producing hookworm disease (uncinariasis, necatoriasis); common throughout the warm moist areas of the Americas, central and southern Africa, southern Asia, Melanesia and Polynesia; an important parasite in the southern United States.

Onchocerca volvulus

(*Onchocerca cutaneous*) — A filarial parasite of man; adult worms live in subcutaneous tumors, especially in intercostal spaces, popliteal spaces and the axillae; the microfilarial larvae are found in the skin usually around the waist; microfilariae develop into infective larvae in an intermediate host (biting flies or gnats of the genus *Simulium*), migrate to the labium and are thus reinoculated into man; found in west and central Africa, Guatemala and southern Mexico.

Physaloptera

A genus of parasitic roundworms rarely encountered in man; reported in man from Africa.

Rhabditis

A genus of predominantly free living roundworms present in decaying organic matter; may be found accidentally in specimens from man.

Strongyloides stercoralis

(*Anguillula stercoralis*; *Anguillula intestinalis*; *Strongyloides intestinalis*) — A parasitic roundworm in man; the cause of strongyloidiasis; the adult female inhabits the wall of the intestine where it deposits eggs in the mucosa; eggs hatch into rhabditiform larvae before passage in stools; these larvae may develop into infective filariform larvae or into free-living adults which in turn produce rhabditiform larvae that undergo a metamorphosis comparable to that of the parasitic stage; most authorities agree that some of the larvae arising from the parasitic generation remain in the body in the alveolar tissues and the cystic duct giving rise to a second parasitic generation without leaving the host (hyperinfection or auto-infection: filariform larvae in moist warm soil bore through the skin of man, usually the bare feet, enter the peripheral capillaries and are passively carried to the lungs; eventually maturing females migrate up the trachea and down the esophagus and finally reach the small intestine where full maturity is reached; fertilization of the eggs probably takes place in the lungs where the relatively small male tends to localize; worldwide distribution in warm climates; present in the southern United States.

Syngamus

A genus of strongylid worms; common laryngeal parasites of cattle and other ruminants and of birds; non-avian species occasionally parasitize the upper respiratory tract of man; worldwide distribution and reported from man in the West Indies, South America and the Philippines.

Syphacia

A genus of oxyurid worms common in mice and rats; reported once in man from the Philippines.

Ternidens deminutus

A strongylid parasite of monkeys and man; infective larval stage must be swallowed before further development; found in Africa and Asia.

Thelazia

A genus of parasitic roundworms having a predilection for the conjunctiva; found in dogs and rabbits, occasionally in man; reported in man from the Orient and from California.

Toxocara

(*Toxascaris*; *Belascaris*) — A genus of ascarid worms parasitic principally in dogs and cats; found in man very rarely, probably as incidental parasites.

Trichinella spiralis

(*Trichina spiralis*) — The cause of trichinosis in man, hogs, rats and other animals; adult worms live in the small intestine; gravid females migrate into the mucosa where larvae are discharged (viviparous) into the lymph spaces of the villi; larvae enter the blood and are carried to various parts of the body where they tend to localize and encyst in the voluntary muscles; infected pork, eaten raw or inadequately cooked, is the principal source of this parasite for man; rats aid in dissemination of the disease among hogs; common in the United States.

Trichostrongylus

A genus of strongyloid worms; common and important intestinal parasites of sheep and cattle but rare in man; distribution worldwide.

Trichuris trichiura

(*Trichocephalus trichiurus*) — The whipworm of man; reinfection by ingestion of material contaminated with egg-bearing feces occurs without an intermediate host; distributed throughout the world, particularly in warm moist regions.

Turbatrix aceti

(*Anguillula aceti*) — The "vinegar eel"; not parasitic; presence in specimens from man accidental.

Wuchereria bancrofti

(*Filaria sanguinis hominis*; *Filaria bancrofti*; *Filaria nocturna*; *Wuchereria pacifica*) — A common cause of filariasis; adults live in the lymphatics of man: sem.-viviparous since hatching of eggs may occur in the uterus or shortly after deposition; microfilarial larvae usually appear in the blood at night only (not true in the Philippines and adjacent Pa-

cific islands); require an intermediate mosquito host (genera *Culex*, *Aedes*, *Mansonia* and *Anopheles*) where microfilaria undergo metamorphosis into infective larvae that eventually migrate into the proboscis of the insect ready for re-inoculation into man; common in equatorial and sub-tropical areas around the world.

Wuchereria malayi

(*Filaria malayi*) — A filarial parasite similar to *Wuchereria bancrofti*; microfilarial larvae in blood exhibit modified periodicity reaching greatest numbers about 4 A.M.; when microfilariae are ingested by mosquitoes of the genera *Mansonioides* and *Anopheles*, development into infective larvae takes place and these migrate to the proboscis awaiting reinoculation into man; found in the Netherlands East Indies, India, Indo-China and China.

VIII. MISCELLANEOUS PARASITIC HELMINTHS (WORMS)

Gordius

A widespread genus superficially related to the round-worms; adults are free living, aquatic forms commonly known as "hair snakes" or "horsehair snakes"; larvae parasitic in insects; presence in man is accidental but has been reported from Florida as causing an abscess of the eyelid in one individual.

Hemodipsa

A genus of small terrestrial or land leeches; wounds from these leeches, often inflicted by many leeches at once, remain open a long time and hence are subject to infection; may work into the nares, nasopharynx, pharynx, larynx, trachea or bronchi; abundant on moist vegetation in tropical rain-forests around the world.

Hirudo

A genus of leeches including species, such as *Hirudo medicinalis*, used formerly for "blood-letting" and now used as a source of hirudin, a blood anticoagulant.

Limnatis

A genus of aquatic leeches causing severe symptoms when ingested with water; occurs in southern Europe, Africa, the Azores, the Canary Islands, western Asia, India, the Malay States, Java and Sumatra.

Macracanthorhyncus hirudinaceus

(*Echinorhyncus gigas*; *Gigantorhyncus gigas*; *Gigantorhyncus hirudinaceus*) — A species of *Acanthocephala* or thorny headed (spine headed) worms, intermediate in position between the roundworms and the flatworms; parasitic in pigs, occasionally in man; larval development occurs in several species of beetles; parasitizes man when larvae-bearing beetles are ingested; found principally in Russia.

Moniliformis moniliformis

(*Echinorhyncus moniliformis*) — A species of *Acanthocephala* or thorny headed (spine headed) worms, intermediate in position between the roundworms and the flatworms; parasitic in rats, mice and sometimes dogs, occasionally in man; larvae develop in cockroaches and beetles; accidental ingestion of larvae-bearing insects leads to parasitism in man; reported from Italy, the Sudan and British Honduras.

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